



# MC-IF PROFILING WG: MOTIVATION AND BACKGROUND FOR SUB-PROFILING

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# Motivation for MC-IF involvement in VVC sub-profiling

- Proposal: MC-IF to serve as a registration authority for VVC sub-profiles, by allocating code points for an MC-IF-specific terminal provider oriented code
- Benefits for industry
  - Improves VVC implementation interoperability by
    - Ensuring that the sub-profiles registered by MC-IF have been clearly and unambiguously described and have undergone review by technical experts
    - Providing easy access to sub-profile description documents and conformance bitstreams
- Benefits for MC-IF
  - Will increase visibility of MC-IF in industry
  - Will encourage companies to join MC-IF to participate in review process

# Background on conformance design philosophy of VVC and HEVC

- The draft VVC specification does not yet contain definition of profiles and levels, but we can expect the general philosophy of the HEVC design to be followed. Some aspects have already been adopted to the VVC spec.
- HEVC distinguishes between conformance of a bitstream and conformance of a decoder
- In HEVC, profile, tier, and level (PTL) terms are used when describing both bitstream conformance and decoder conformance, but with a different interpretation

# Profile, Tier, and Level bitstream conformance

- HEVC has a syntax structure to signal profile, tier, and level (PTL) within a bitstream
  - PTL indication describes characteristics of the bitstream, particularly the restrictions to which the bitstream adheres
    - Profile: Allowable set of coding tools, as defined by indication of which tools described in the overall standard are forbidden from being used in the profile
    - Tier: Upper limits on bitrate of the bitstream, as defined by the Hypothetical Reference Decoder (HRD)
    - Level: Upper limits on picture resolution, sample rate, and bitrate of the bitstream and decoded pictures
  - A bitstream which obeys the rules of the overall standard and obeys the restrictions of its signaled PTL is considered to be a conforming bitstream
    - Although there is no “MPEG Police” or enforcement mechanism, bitstreams which mislabel the PTL are considered illegal, or non-conforming
      - Decoders are not required to decode non-conforming bitstreams
    - The PTL describes worst case constraints. It is not required that the most restrictive possible PTL description of the bitstream be used.
      - Example: It is legal for a QCIF resolution bitstream to use the level indication normally used for 4K

# Profile, Tier, and Level decoder conformance

- A decoder which conforms to a particular PTL, when given a conforming bitstream labeled with a particular PTL value, shall output decoded pictures which exactly match those created by the reference decoder defined in the specification
- Decoders may conform to multiple PTL operating points
- Tiers and levels are hierarchical, and some but not all profiles have hierarchies. Any profile hierarchies are explicitly defined in the specification.
  - A Main Tier Level 4.2 decoder must be capable of decoding a Main Tier Level 4.1 bitstream
  - A Main 10 Profile decoder must be capable of decoding a Main profile bitstream
  - An HEVC Main 10 Profile decoder is not required to decode a Monochrome 10 profile bitstream
- Decoders are not required to decode bitstreams which conform to profiles not supported by the decoder, and may discard them

HEVC Levels	
Level	Resolution: frame rate
1	176 x 144 : 15
2	352 x 288 : 30
2.1	640 x 360 : 30
3	960 x 540 : 30
3.1	1280 x 720 : 30
4	2048 x 1080 : 30
4.1	2048 x 1080 : 60
5	4096 x 2180 : 30
5.1	4096 x 2180 : 60
5.2	4096 x 2180 : 120
6	8192 x 4320 : 30
6.1	8192 x 4320 : 60
6.2	8192 x 4320 : 120

# VVC design, as of VVC specification Draft 5

- VVC spec Draft 5 will reflect the decisions of the March 2019 meeting, expected to be available in April 2019
- Includes in PTL syntax structure:
  - List of constraint flags/syntax elements
    - Specified in VVC spec
  - Sub-profile indicator syntax element
    - 3 bytes allocated in VVC spec
    - Contents specified by ITU-T T.35, outside of VVC specification
- No profiles, tiers, levels defined yet, but for ease of discussion will assume that a Main profile will be defined

# Background: General points on VVC sub-profiling

- Any organization with an ITU-T T.35 Terminal Provider Code may define a VVC sub-profile, with no requirement to publish any information about it
- In theory, up to  $2^{24}$  sub-profiles can be defined per VVC profile
  - Limited by allocation of code points to countries, terminal providers
- Conforming decoders may safely ignore the sub-profile indicator value
  - Any decoder which conforms to the “full” profile is required to be able to decode any bitstream with any indicated sub-profile value
- Decoders may choose to conform to a sub-profile of a profile, and not the full profile
  - It has been long been common practice for implementations to conform only to restrictions to AVC/HEVC profiles defined by application specs
    - Example: DVB specifies particular supported resolutions & frame rates

# Example – Progressive Main sub-profile

- Assume that VVC will define a Main profile
- Could define a Progressive Main sub-profile of Main profile, and assign a sub-profile indicator code point for it
  - Would impose the following constraints on syntax element values:
    - `general_progressive_source_flag` equal to 1
    - `general_interlaced_source_flag` equal to 0
    - `general_frame_only_constraint_flag` equal to 1
- A Main profile decoder could decode a bitstream conforming to the Progressive Main sub-profile of Main profile, as indicated by sub-profile indicator syntax element value
- A particular decoder implementation may choose to conform to Progressive Main sub-profile of Main profile while not supporting the full Main profile
  - If this decoder receives a Main profile bitstream without the a sub-profile indicator value indicating Progressive Main sub-profile, it may discard the bitstream and not attempt to decode it



# Associated work for MC-IF

- Apply for an ITU-T T.35 terminal provider code
- Define a process for allocation of a sub-profile indicator code point
  - Strawman process has been made available, as a starting point for discussion
- Communicate with industry about the process
- Implement the process. Details will depend on defined process, but may include the following:
  - Technical expert review of proposals in Profiling WG
  - Voting handled by VTM
  - Publish information on website about allocated sub-profile indicator code points